vision of the Board of Trustees, and that of the latter the medical and scientific work of the Hospital, and nothing else. To many Superintendents this would be depriving them of the sweet morsel which they roll so consolingly under the tongue, but the better class of such would hail it as a great relief, as time would then be afforded them for work, for which they have long and anxiously awaited an opportunity, and for which they wait in vain under the present *régime.*

Then will genuine progress in the field of practical psychology begin in America. Then and not till then will we have careful study of the cases in our Hospitals, and the application of better methods in their treatment.

ART. IV.—NERVOUS EXHAUSTION, OR NEURASTHENIA, IN ITS BODILY AND MENTAL RELATIONS.

ONE OF A COURSE OF LECTURES ON THIS SUBJECT, DELIVERED AT THE CHICAGO MEDICAL COLLEGE, BY J. S. JEWELL, M. D., SESSION OF 1878-9.

LECTURE II.

GENTLEMEN: In my last lecture I gave you a brief account of the principal phenomena or symptoms of *neurasthenia* or nervous exhaustion, to-day I shall try and explain them. You will remember, that the chief symptoms of neurasthenia, are always loss of nerve-power, and usually excessive increase of sensibility, in some one or more of its various forms.

I shall enter into this subject with some particularity, for simple as the philosophy of neurasthenia is, when it is once clearly stated, I am persuaded but few understand it as they ought to do, in order to make their knowledge of practical value, in dictating rational, consistent plans of treatment. My present aim then, is to state as clearly as I can, the actual physical conditions on which the symptoms depend. I should premise, however, that these conditions are not matters of direct physical demonstration, but of inference. However, this should be no real bar to our belief in the reality of these conditions, provided the inferences which lead the way to them are well based, that is, have sound and broad premises, and if they are the outcome of cautious reasonings founded thereon. In the physical science of to-day, there is clearly too little dependence on, because there is so much ignorance of, the nature and conditions of inference. It is almost habitually placed at a disadvantage as compared with direct sense observation and physical demonstration. But this arises out of wrong conceptions as to its nature and value, as well as out of an over-estimate of the dependence which we may legitimately place on the "evidence of the senses." From these remarks you may gather, that I am aware of the real nature of the description I am about to give, and also of the objections which a too realistic scientific spirit might raise against it as to its substantial correctness. Having said so much aside from the main current of my subject, I will go on without farther interruption.

Broadly speaking there are two grand phases to nutrition. They are strictly complementary to each other. They are *waste*, and following in its wake, *repair*. On the one side there is a wearing out with all that this complex process implies; on the other there is a rebuilding or repair, of the damage suffered by the living, and therefore acting tissues which compose the body. In this process, the blood plays a most conspicuous part, for it not only embodies the materials for effecting the needed repair of damage, for which purpose it is conveyed into the midst of the tissues, and irrigates them, but it becomes on the other hand one of the chief means for conveying from the tissues, to the various emunctories of the body, the waste matter which results from their wear and tear.

The blood in its turn depends, for its richness and perfection as a store-house of materials for the repair of the tissues, on two chief circumstances: that is, the efficiency of the digestive system, and of the lungs, on the one hand, and on the other on the perfection of those purifying processes as regards the blood, which pass under the name of excretory functions. And so we might go farther back in a regressive order, to the character of the food taken, the purity of the air breathed, to the causes or conditions and the consequences of disordered action of the excretory organs, etc. But this would lead us at present too far away from the point to which I wish to direct your steadfast attention, viz. : *the condition of the nerve structures in neurasthenia.* By nerve structures I mean nerve cells and fibres, especially the former, for they are the seats of nerve activity *par excellence.*

I suppose it will be admitted by all, that the nervous, like other tissues, when in action, undergo minute or delicate changes, not only as a *consequence* but in some sense as a *cause* of their action. We are fully warranted in assuming that it is not possible for an impulse to be transmitted along a nerve fibre, whether sensory or motor; that it is not possible for a reflex act to occur, however simple; that it is not possible to think, or feel or exercise volition, without the occurrence of some material change, however slight, some destructive molecular change in the fibres and cells which may have been the seats of such action. At its conclusion, the cells and fibres involved are not in the same physical condition as when the action was begun. However powerless our present methods of physical investigation may be to demonstrate it, yet it must be a fact, all the same, that there has been a more or less delicate, diffuse wearing out or substantial loss in the tissue in question. And this substantial loss, or impairment of structure, is not confined to the surface of the cell or fibre, as it is in the wearing out of some portion of an inanimate machine, but is probably diffused all through the interior of the cell or fibre, from circumference to centre and *vice versa.* It is interstitial. Evidently, this process of wear or waste will be slow or fast, small or great according to the intensity and duration of the action which occasions it. If the process is slight in degree no noticeable symptoms are produced. But if it is carried to any considerable extent, one symptom at least is shown : that is *fatigue.* This arises from and therefore indicates, not only a very considerable degree of material waste or wear, but it indicates and is the direct sign of a waste or *loss of power.* This wear or loss of living substance carries infallibly with it a loss of power, and fatigue or a sense of exhaustion, *as a rule*, is the sign of it. It is a plain indication usually, that the process of material wear or waste of the active tissue, and that corresponding exhaustion of power with which the tissue is stored, has gone as far as it can go without endangering to any unhealthy extent the integrity of the tissue itself. Fatigue is the inarticulate remonstrance from the worn, exhausted tissue, that the process of waste ought to stop, and give place, without let or hindrance, to the opposite process of repair and re-invigoration. This is what we call *rest*. The activities of the worn tissue are made to cease, while the process of interstitial repair is permitted to go on, until the substantial loss is made good, until wasted energy is restored, hand in hand with the repair of structure, and then fatigue gives place to that state of feeling, the which when it has come, we say we are *rested*, and we are ready once more for another period of activity; and so on from fatigue to rest, and from rest to fatigue, so long as the conditions of health are or can be observed. A substantial daily equilibrium is attained and maintained between waste and repair. All other things equal, this is health.

This *temporary fatigue* which I have described is not neurasthenia proper, but the only circumstances which prevent us from calling it neurasthenia are these : *degree and persistence or permanency*. If for any cause (and there are many causes), the degree of material waste and exhaustion of power should be so increased that a healthy degree of repair cannot soon or at all occur under the circumstances of a given case, there would be at once a case of neurasthenia, or nervous exhaustion. There would then be persistent or permanent exhaustion or fatigue, for the reasons I have given, and the state of the nerve cells and fibres involved, as regards structure and power, would be as I have described.

Neurasthenia implies, then, simply the carrying of a natural, healthy process, to an unnatural or unhealthy degree. Nerve cells and fibres are not destroyed, but unduly worn and exhausted, and this varies in degree between wide extremes.

In a well-marked case of neurasthenia, the loss of substance from excessive wear and tear is so great, and the exhaustion of power is so complete, that even a prolonged period of rest, under favorable circumstances, may be insufficient to secure a healthy degree of repair, and restore wasted energies, so as to remove a sense of chronic fatigue, and exchange it for an inward sense of rest, of vigor, of a spontaneous tendency to activity.

Such is neurasthenia, pure and simple, considered apart from its remoter conditions or causes. I hope you have followed me closely enough to get clearly in your minds, what is the presumed actual condition of the nerve structures in neurasthenia.

I am aware that I have been stating matters which are quite well known, at least in a certain sense. But it should be remembered that the golden rule, not only of all teaching, but of all learning, is to begin with things we do know, and guided by the clues of similarity and identity, pass to the unknown. But we must start with the known and hence I begin with what is familiar, in order to lead you to what is not so familiar.

So it turns out, that there is a real, pervasive nutritive lesion of nerve structure in neurasthenia. Waste has morbidly preponderated over repair. The nervous system becomes lean. This involves necessarily, loss of power, and undue sensitiveness, or "shakiness" of the nervous system. It is more easily excited than when healthy, and the excitement when once produced, radiates farther, and endures longer, than in health.

This state or physical condition of the nerve structures, differs in degree in various cases, or at different times in the same case, from a very slight exhaustion, to that which is the most profound. It may extend to the whole nervous system, or to only a small part of it, or if to all parts, unequally so to different parts. It may be in part hereditary, or it may be acquired. It may affect chiefly the bodily functions, or it may affect chiefly the mental functions, as in some cases of melancholia, or it may involve both at the same time in varying ways and proportions, as often happens.

But this nutritive lesion just described is not the only, though the most important, condition of neurasthenia. There is one more at least, which I wish to place distinctly before you. It consists in a morbidly fluctuating blood-supply to the affected parts of the nervous system. The nutritive lesion described, seems always to involve an unsteady circulation of blood in the part which has suffered. Especially is the blood-supply likely to *fluctuate rapidly*, from a too free and tumultuous supply for healthy nutrition, down to a partial anæmia. Nutrition in the part in question is therefore irregular and unreliable. Hence nervous action is unsteady and unreliable.

The condition of the walls of the blood-vessels themselves, and of the local vaso-motor mechanisms which control them, in the diseased nervous centres, is much the same as that of the worn nerve elements in the midst of which they are. The local vaso-motor apparatuses become worn and exhausted, and the muscular walls of the vessels in the seat of disease lose their tonus in a measure, and give way before any increase in blood-pressure with abnormal ease, and this is one of the chief conditions of a fluctuating circulation of blood in the diseased nervous centres. When it is known how sensitive are the higher nervous centres to changes in the pressure and quantity of the blood circulating in them, it will not be difficult to understand how rapid and extreme fluctuations in blood-supply may give rise to many symptoms, varying according to the function of the part which is the seat of the disorder.

Such then, in brief, are the two physical conditions of the nervous system in neurasthenia, to which I have wished in the outset to direct your attention. Simple as they may be, I must insist that you clearly apprehend and bear them in mind.

Out of these grow other conditions of importance already alluded to, of which the more important are the following:

1. Loss of power, either physical or mental, or both. Such patients are unable to do or endure what they are able in health to do or endure.

2. Augmented sensibility either in the domain of the lower physiological sensibilities, or that of the emotions. In neurasthenia, patients are usually more easily affected than the same persons are in health.

3. Reflex excitability is greatly exaggerated, as a rule, in all

directions. This depends partly on morbidly increased mobility of the nervous system, and partly on a loss of that control which the higher centres exert over the lower ones, but especially which the highest part of the brain, which is the seat of the will, exerts over the lower centres in the brain, medulla and cord, the tendencies in which to reflex responses to the excitations which reach them from various quarters, the will centres control. This power of the brain for the control of the lower centres in neurasthenia, is exhausted in various degrees the same as other forms of nerve power, and hence the difficulty of control in such cases. Between the positive gain in reflex excitability in the central as well as more peripheral parts of the nervous system, and the positive loss of power for control, or of inhibitory function, reflex excitability is seen to be greatly augmented. Impressions reaching the spinal cord, medulla, or brain, either by the sensory nerves of the peripheral nervous system, or from the cortex of the brain above, from the seats of emotion, by the way of the fibres descending from the cortex to enter the cells of the basal system, or medulla, or spinal cord, are projected into reflex mechanisms more responsive than they are when healthy, and not only do they respond more readily to the impressions which reach them, but these impressions meeting less resistance, irradiate throughout the nervous system more freely than they should do normally, and create a disturbance more wide and more enduring, as the neurasthenia is more profound. This undue reflex excitability is shown in many ways: 1. In an abnormal tendency to involuntary muscular action. The type of this kind of manifestation of augmented reflex excitability is chorea, and almost on a par with it is hysteria. But it is shown in very many other diseases, as I shall try to show you before I am done with this course of lectures. 2. In abnormal increase of the cardiac and vaso-motor reflexes. This is a point of extreme importance in neurasthenia, and is one on which I must dwell to some considerable extent.

It is now known, as never before, that the vascular system sustains very close and important relations to the nervous system. The heart has not less than three kinds of nerves, functionally speaking, going to it, and not less than one kind going from it. Those going to the heart are the cardiac motor portion of the vagus (probably inhibitory), the accelerator nerves (Cyon, Ludwig,) from the cervical and dorsal sympathetic, and the vaso-motor nerves of the vessels proper of the heart. Aside from the more ordinary nerves of the heart, if not to be included with them, is the "depressor" nerve of the heart—a sensory cardiac nerve, which arises largely, it is probable, from the endocardium, and proceeds to the medulla, for important and widespreading reflex purposes.

Then there are the muscular arteries, especially before they terminate in the capillaries, which are, like the heart, supplied by nerves. They have, first, local apparatuses of ganglion cells, which probably receive fibres from, and emit fibres to, the vessels. Each vessel has, thus, its own independent nervous supply. But these local apparatuses are connected and co-ordinated by apparatuses, have a wider sweep of relations, and hence the larger, more central ganglia of the extra spinal portion of the so-called sympathetic nervous system. But, like the automatic and intrinsic apparatus of ganglion cells and fibres of the heart, which is connected by means of the vagus and accelerator nerves with the grey matter of the cord and medulla, so with these local extra-spinal nervous apparatuses of the vessels. They are freely connected with the grey matter of the spinal cord by means of fibres which pass out (from the cord) to terminate peripherally, not in the muscular tissue of the walls of the vessels themselves, but in the ganglia and ganglion cells of the peripheral vaso-motor mechanisms, which, in their turn, stand in immediate relation with the vessels. These vaso-motor nerves, which proceed out from the grey matter of the cord, probably, as just described, control the action of the peripheral apparatuses in which they terminate in much the same way, doubtless, as the vagus and accelerator nerves do the action of the intrinsic motor ganglia of the heart.

There may be, functionally speaking, even two kinds of vaso-motor nerves passing out from the grey matter of the spinal cord, as has been supposed—constrictor and dilator, comparable to the slowing and accelerator nerves of the heart.

But one thing is now certain: viz., that vaso-motor nerves are emitted from the cord—in all probability from its grey matter. It is true it yet awaits practical demonstration; but it has long seemed highly probable to my mind, that there is a tract of grey matter in the spinal cord out of which the spinal vaso-motor nerves arise, passing out chiefly by way of the anterior (motor) roots of the spinal and cerebral nerves. This supposed vaso-motor tract in the grey matter of the cord, if it exists (as I believe it does), must extend—differently from what many seem to suppose—the whole length of the cord, up into the medulla, side by side with the better known musculo-motor tract in the grey matter of the cerebro-spinal axis.

In the medulla, and perhaps in the basal system of ganglia, which I have described to you, this central vaso-motor tract culminates in a chief or supreme centre, toward which all vaso-motor centripetal impulses tend, and from which may issue in return those impulses which may by descending the spinal cord, and passing out from it at various heights, by the way of the fibres just described which pass out towards the vessels, affect thus the action of any or all parts of the peripheral vascular nervous apparatus. In this view the entire vaso-motor nervous system is summed up in the medulla and—perhaps—basal system. By this means the vaso-motor nervous apparatus is placed in close relation with the cardiac, the chief centres of which lie also in the medulla, so that these two parts of the grand vaso-motor nervous apparatus may affect each other or be affected by the same causes, so they may in general terms, have close relations in regulating the circulation of the blood.

Now the action of this great nervous apparatus (vaso-motor) is essentially the same as that of other parts of the nervous system. It acts in a reflex way. But from what sources come the excitations by which its action is excited or affected? In health in the case of the heart, it is probable that some impressions made in this organ, perhaps on its interior lining membrane by the blood, are conveyed to its motor ganglia, and these react through motor fibres on the muscular tissue in the walls of the heart. But beyond this, there must be fibres which arise from the heart, and which are for the purpose of conveying directly to the cord and medulla a knowledge, as it were, of the condition of the heart, for the purpose of securing reflex responses, either through the slowing or accelerator nerves, according as the heart needs to change its action, as it does from time to time. But can the action of the heart be changed alone in the manner described, by excitations starting in the heart itself, and returning to it through the purlieus of its nervous mechanism as just described? May not the sources of excitation be extra-cardiac? Most certainly so in my opinion. The original seat of irritation may be the mucous membrane of the stomach, as it so often is, or of the bowel below, or it may be in the genito-urinary mucous surfaces, as happens in thousands of cases, or it may be in the skin, or it may be by way of the organs of the special senses, or more important yet, it may be in the cortex of the brain, which is the proper seat of mental action, whatever its kind; from any or all these sources, the excitant influences may start, which, when they reach the central cardiac nervous apparatus in the medulla, may excite it, just as certainly in a reflex way as it could be by impulses arriving at the same point from the heart itself. Hence it comes to pass that irritation of the stomach, or of the sensitive genito-urinary surfaces, or irritations of the skin, or excitation of the cortex of the brain, and of many other sensitive parts, give rise to disordered heart action, in various degrees and ways.

The same that can be said of cardiac nervous action, and reflex disorders of the same, may be said of the action of the vaso-motor apparatus proper. It may have, and has, its local limited disorders, independent of the action of the spinal cord and medulla. But it is more common by far to find, that the circulation of the blood in some part of the body, or even of the whole body, has been affected by means of influences exerted on the spinal cord, or its grey matter, and from this outward by the channel of the nerves which I have described to you as passing between the cord and the peripheral vaso-motor mechanisms, upon which the vessels immediately depend. According to the character of the influence which passes out from the cord, the vessels will contract or dilate, and hence admit more or less blood, in a given time, to the part, whatever it may be, the vessels of which are acted on.

The excitant influences affecting the action of the vaso-motor apparatus may come from any or all the sources already described, in relation to the heart: viz., from the vessels themselves, more or less directly, by way of any nerve of sense whether general or special, or from the brain above, the excitation in this case starting in its cortex, and descending its fibres to the motor and vaso-motor grey matter of the medulla and cord, in which many of its fibres directly terminate, and the action of which is thus excited—in any or all these ways may the central vaso-motor tract be affected, so as to emit the nervous influence, which may finally change in varying degrees the circulation of the blood in different vascular areas of the body, and in so doing, change the rate of nutrition of such parts, and by consequence, everything depending on the same.

Now this really important part of the nervous system shares with others in the loss of power and gain in reflex excitability, observed in neurasthenia, and hence the feebleness, excitability, and irregularity in action of the vascular system in neurasthenia. It is easily excited by impressions of a comparatively trivial character, either from the sensory *peripheral* nervous system, or any part of it, or from the brain. The circulation fluctuates under the slightest provocation, of course, under influences won from the vaso-motor nervous system. The heart responds by palpitations and irregular action with abnormal facility, and in this way the whole circulation is modified, at times, so as to produce the most alarming symptoms. In like manner the muscular vessels contract or expand with great facility and irregularity, so that rapid changes in the amount of blood in a part occur, thus giving rise to a legion of symptoms, according to the functions of the organ which may happen to be the seat of the fluctuation in blood-supply, and the action of which by such means may be changed. This fluctuation in blood-supply is especially likely to occur in the spinal cord and brain, giving rise in this way to many symptoms, as may be seen more in detail hereafter. Under this same head of fluctuation of the circulation, should also be mentioned changes of posture as a cause. In cases of neurasthenia, there is usually, if not always, a general diminution of vascular tonus. This makes it possible for changes in posture to produce sudden variations in blood tension, especially in and about the brain. Hence it comes to pass that such patients, if they suddenly rise to the sitting or standing from the recumbent posture, often immediately turn pale, experience vertigo, obscurity of vision, tinnitus, sudden change in the heart's action, confusion of mind, and at times syncope, and many other less striking examples of the same kind.

It is true, that symptoms produced in the way just described may depend, to a great extent in some cases and to some extent in all, on a *diminished volume* of the blood. But it more often depends on a loss of vascular tonus, and this depends on exhaustion (or neurasthenia) of the vaso-motor nervous system, which shares in varying measure the fate of other portions of the nervous system.

But I cannot now go farther into a study of the organic conditions which underlie neurasthenia. They are, I may repeat, a lesion of nutrition, and irregularity, and sudden fluctuations in blood-supply, especially to the cord and brain. Let these conditions be clearly had in mind. This being done, I will proceed to show you some of the more important *remote* causes or conditions of neurasthenia. This will be given in my next lecture.